Purpose of ACAT:

Analytica COG Analysis Tool

To enable rapid analysis of the uncertainties in the Cost of Generation (COG) spreadsheet, including:

- Range sensitivity analysis
- Monte Carlo simulation, to estimate probability distributions over LCOE, and evaluate an importance analysis
- For one or several generating technologies.

How it works

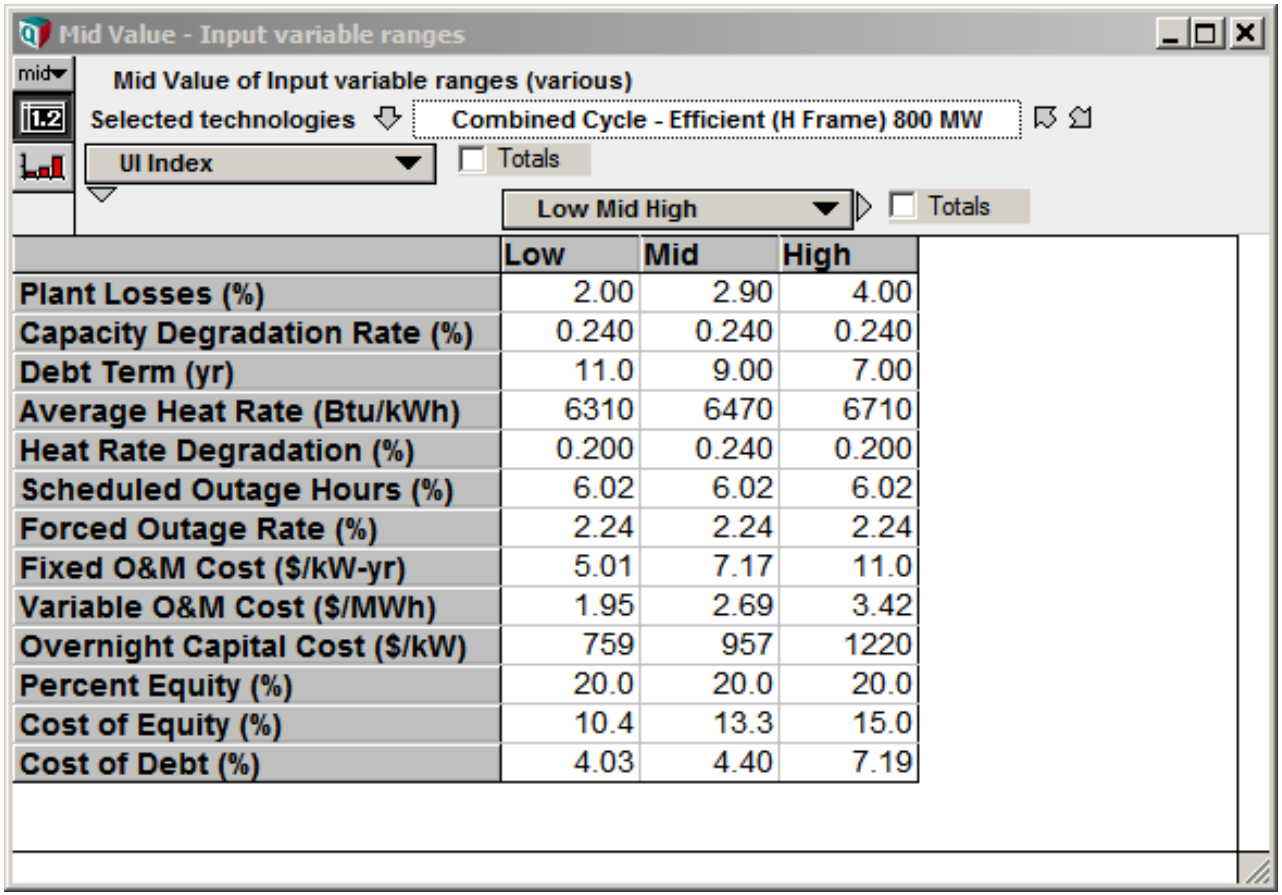
Range sensitivity analysis: For each uncertain input assumption, it uses COG to calculate the effect on LCOE of changing that input over its range from low to high value, while keeping all other inputs at their mid value.

Monte Carlo simulation: It fits a probability distribution (uniform or triangular) to the low, mid, and high values of each uncertain input assumption. It selects n random samples from the input distributions, sets the corresponding input in COG to each sample, and generates the corresponding n samples for LCOE.

For a custom set of plant types, it iterates the above over each plant type.

Input values

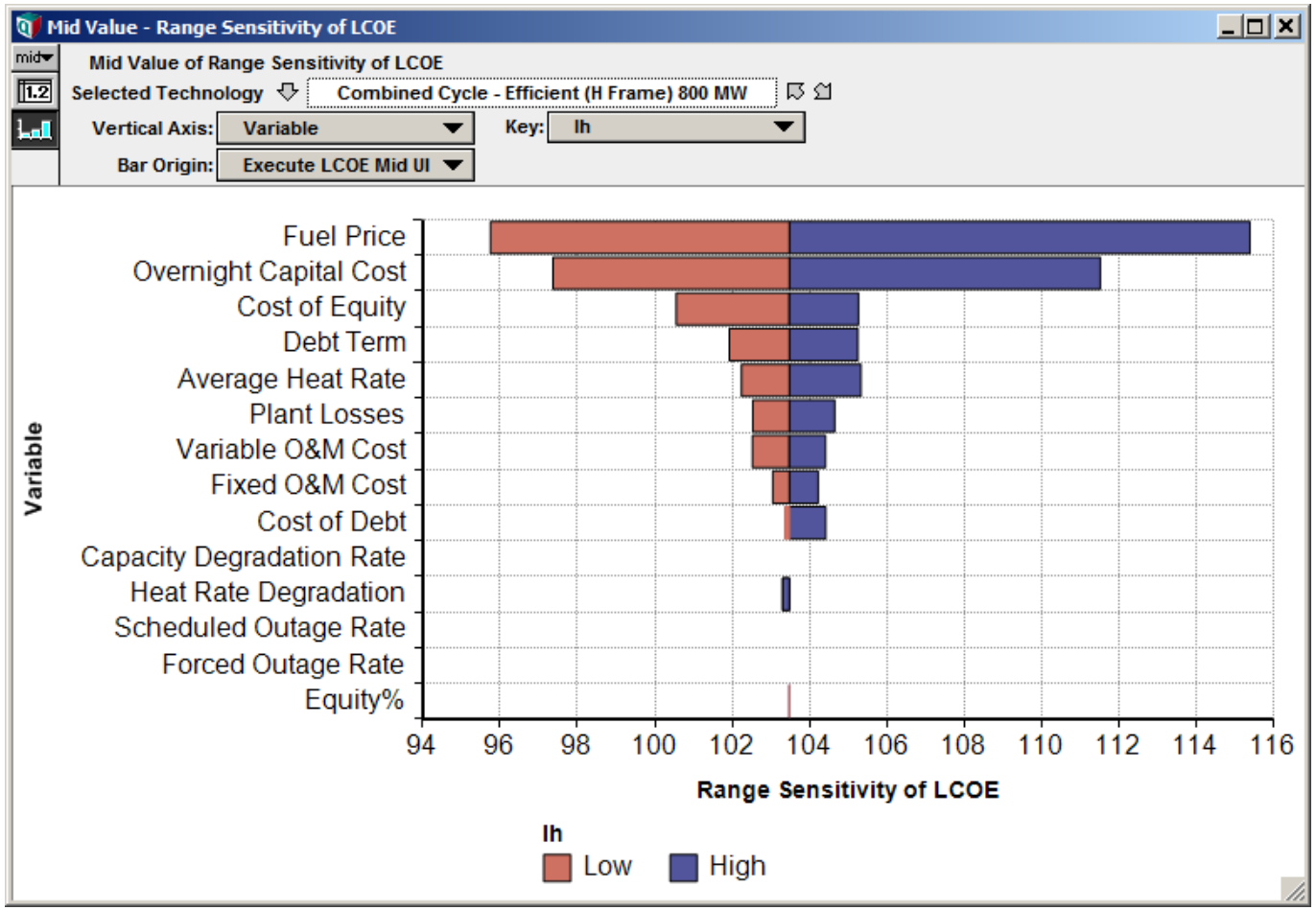
- Low, mid, and high values for each uncertain input assumption, for each Plant type.



	Low	Mid	High
Plant Losses (%)	2.00	2.90	4.00
Capacity Degradation Rate (%)	0.240	0.240	0.240
Debt Term (yr)	11.0	9.00	7.00
Average Heat Rate (Btu/kWh)	6310	6470	6710
Heat Rate Degradation (%)	0.200	0.240	0.200
Scheduled Outage Hours (%)	6.02	6.02	6.02
Forced Outage Rate (%)	2.24	2.24	2.24
Fixed O&M Cost ($/kW-yr)	5.01	7.17	11.0
Variable O&M Cost ($/MWh)	1.95	2.69	3.42
Overnight Capital Cost ($/kW)	759	957	1220
Percent Equity (%)	20.0	20.0	20.0
Cost of Equity (%)	10.4	13.3	15.0
Cost of Debt (%)	4.03	4.40	7.19

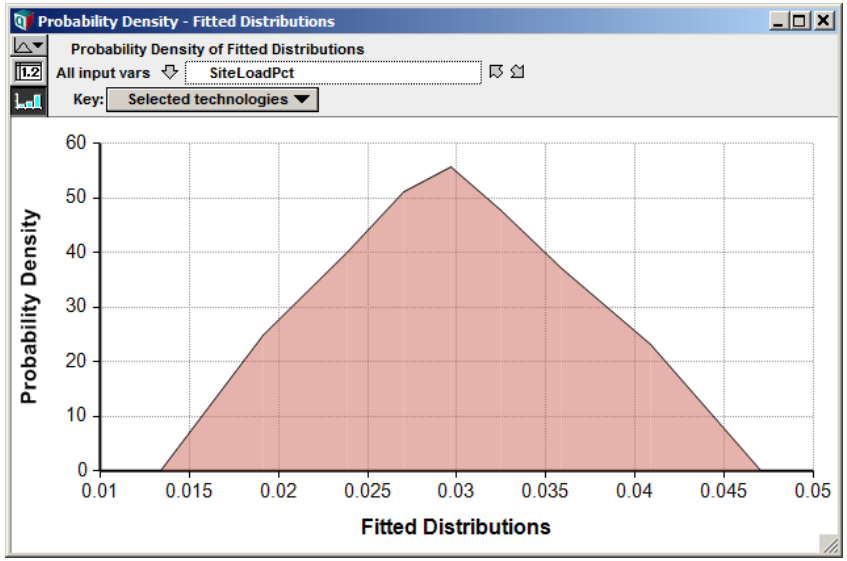
Range sensitivity analysis

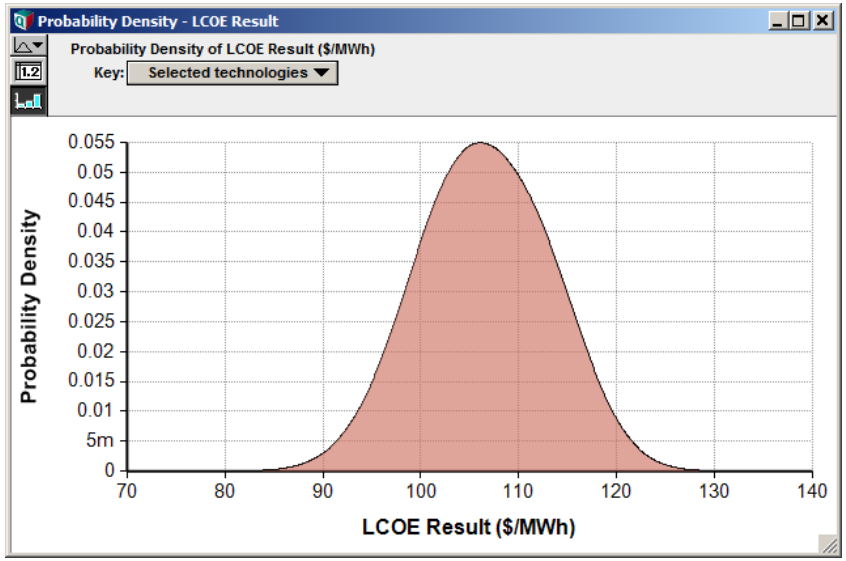
- For each uncertain input assumption, it uses COG to calculate the effect on LCOE of changing that input over its range from low to high value, while keeping all other inputs at their mid value.



Monte Carlo simulation

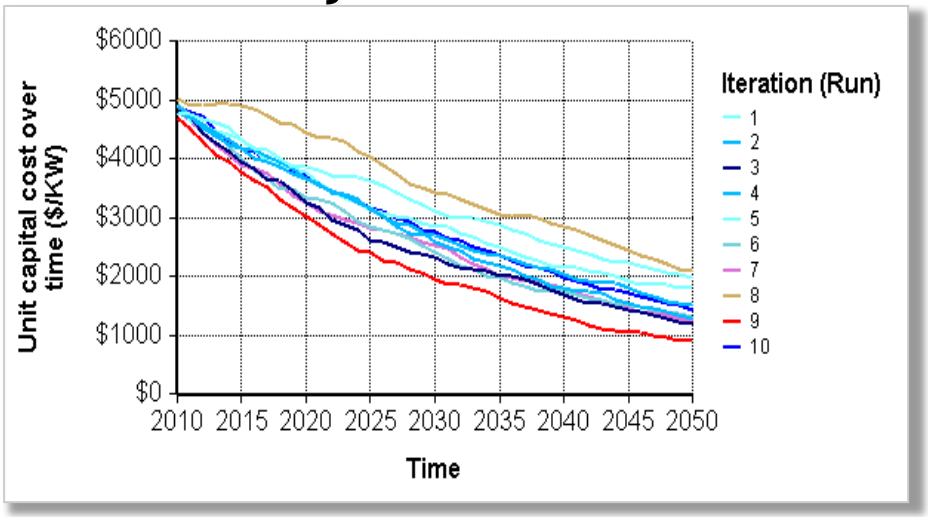
- It fits a probability distribution (uniform or triangular) to the low, mid, and high values of each uncertain input assumption.
- It treats low and high as 10th percentile and 90th percentile of distributions.
- It truncates distributions at specified minimum (usually zero) and maximum.
- It selects n random samples from each input distributions.
- For each of the n samples, it sets the corresponding inputs in COG, and calculates the corresponding results LCOE.
- It estimates the corresponding distribution for LCOE.



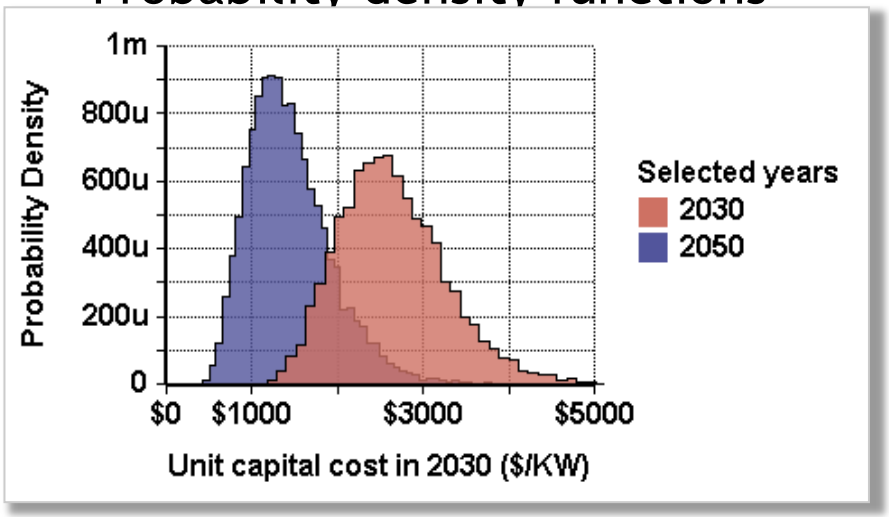


Ways to visualize uncertainty

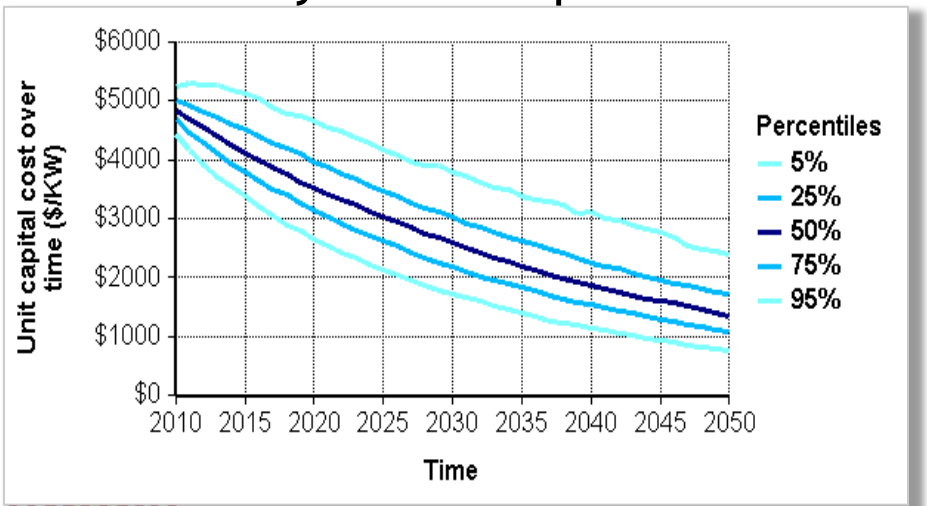
10 cost trajectories drawn from



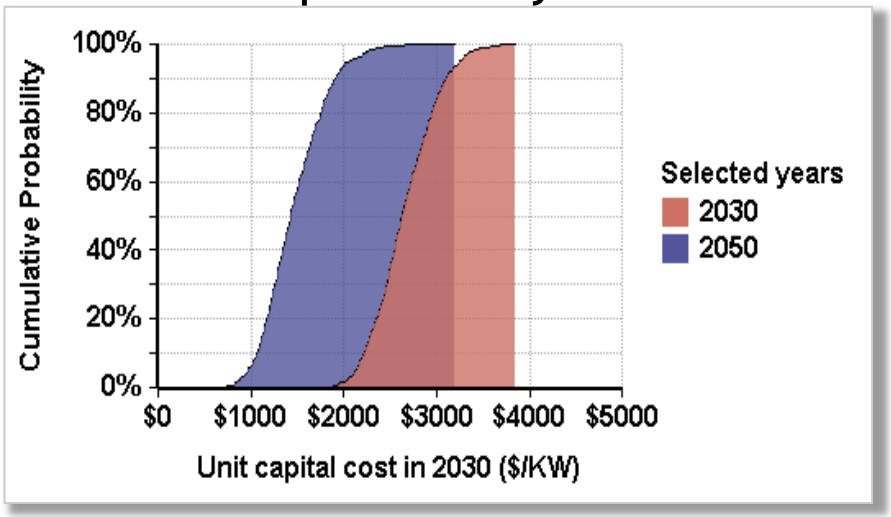
Probability density functions



Probability bands or percentiles

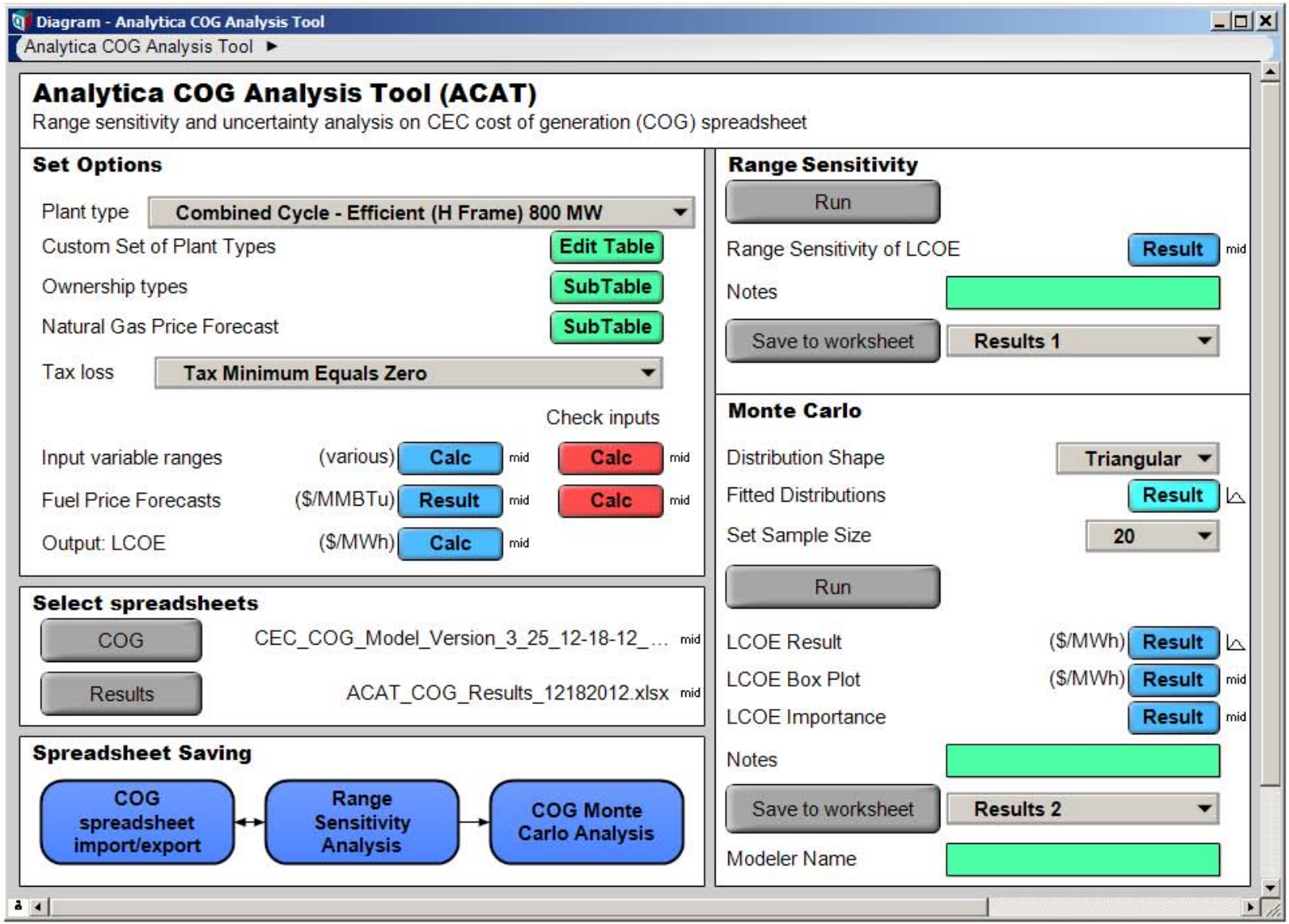


Cumulative probability distributions



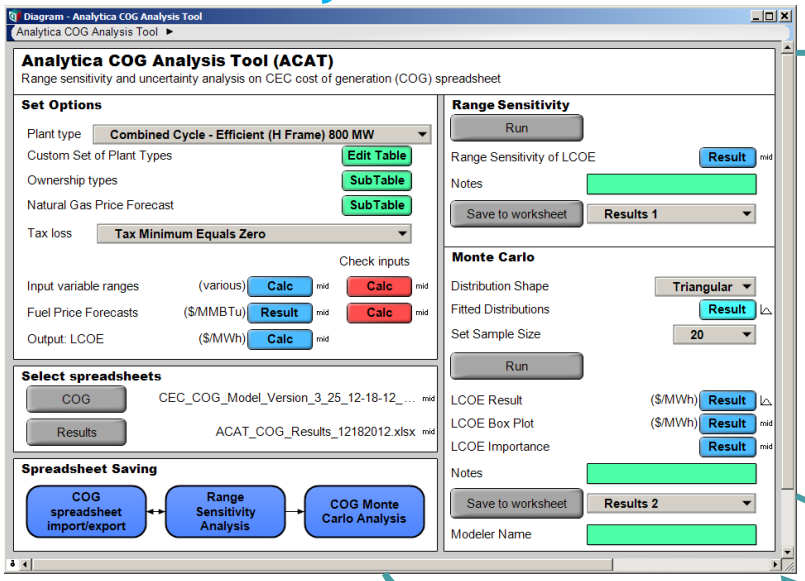
Lumina DECISION SYSTEMS

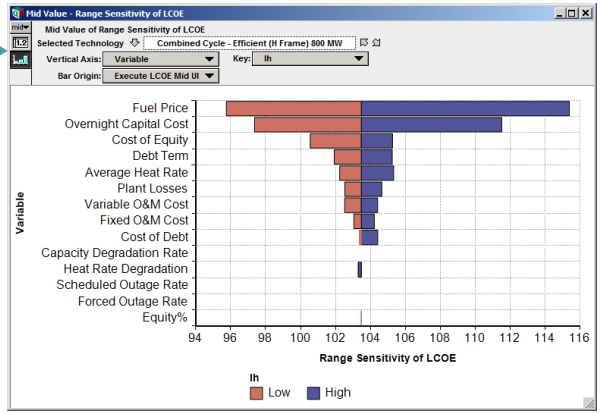
ACAT User Interface



Architecture

ACAT Analytica model





COG spreadsheet

	A	B	C	D	E
1	**Cost Of Generation**				
2	Plant type	Wind-Class 3 50MW			
3	**Input assumptions**			**Output result**	
4	Plant losses (%)	15		Levelized cost of	0.18
5	Debt Term (yr)	13		electricity ($/KWh)	
6	Average Heat Rate (Btu/kWh)	130			
7	Overnight Capital Cost ($/kW)	1800			
8					

Sheet1 Sheet2 Sheet3

Results spreadsheet